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Original Article

Cognitive distortions and academic performance among undergraduate medical students in Pakistan: a cross-sectional study

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Abstract

Background & Objective: Cognitive distortions are maladaptive thinking patterns that may impair learning, academic performance, and emotional well-being. Medical students are particularly vulnerable due to high academic pressure. Evidence on their prevalence and academic impact remains limited. This study aimed to assess the correlation between cognitive distortions and the academic success of medical students using the previous year's professional exam results.

Materials & Methods: This cross-sectional study was conducted among 242 MBBS students and recent graduates using the 25-item Cognitive Distortions Scale related to Academic Achievement (CDS-AA). The internal consistency of the scale was assessed using Cronbach's alpha. To examine associations with academic performance, we employed Pearson correlation and multiple regression analyses, using the participants' previous professional examination scores as the outcome variable.

Results: The mean CDS-AA score was 81.51 (SD = 11.87); 16% showed high distortion levels. Total CDS-AA scores were negatively correlated with previous professional examination score (%) ($r = -0.417$, $p < 0.001$). Catastrophizing was independently associated with lower previous professional examination scores ($B = -0.441$, $p = 0.003$).

Conclusion: Cognitive distortions, particularly catastrophizing, are associated with poorer academic achievement among medical students. Early identification of cognitive distortions and academic counselling are needed to support student well-being and academic performance.

Keywords: students, medical; cognition; catastrophization; academic performance; cross-sectional studies; psychometrics

Introduction

Cognitive distortions are patterns of irrational thought in which individuals draw illogical conclusions about themselves and others [1]. This concept, central to Aaron Beck's cognitive theory, suggests that distortions mediate the link between dysfunctional attitudes and automatic negative thoughts [2, 3]. These automatic processes often lead to unconscious, negative interpretations of experiences, which then solidify into irrational conclusions [4, 5]. A study across Pakistani medical colleges found that negative cognitive styles correlate with depressive symptoms [6], underscoring how students' perception of academic challenges can shape their mental health and performance. Cognitive distortions are prevalent among student populations at all educational levels. Research on children aged 8–11 years revealed significant distortions related to problem-solving beliefs [7]. In Bangladeshi higher secondary schools, over 40% of adolescents exhibited cognitive distortions and antisocial behaviour [8]. Among Palestinian nursing students, 85% reported some level of cognitive distortion [9].

Educational psychologists have long recognised that academic outcomes depend not only on intellectual

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ability or content knowledge, but also on executive functions and emotional regulation when facing academic challenges [10]. Bandura's social cognitive theory posits that self-efficacy beliefs enable students to tackle difficult tasks and persist through setbacks, ultimately improving performance [11]. Similarly, attribution theory suggests that how students interpret positive and negative events, often influenced by cognitive distortions, predicts subsequent academic results [4, 12, 13].

Several mechanisms link cognitive distortions to academic performance. Students prone to negative thinking experience heightened test anxiety, which impairs cognitive functioning and lowers results [14]. They may also perceive a single subject failure as a total personal collapse [15]. All-or-nothing thinking hinders acceptance of minor imperfections during exams [5] and impairs memory, attention, and problem-solving [16]. Negative self-beliefs rooted in social anxiety further disrupt cognitive processes, self-esteem, and academic achievement [17].

Pakistani academic environments show frequent cognitive distortions. Nearly half of medical students attribute success to luck rather than competence, according to impostor syndrome research [18]. Studies demonstrate strong links among social anxiety, cognitive distortions, and reduced life satisfaction among students [19]. Medical students face financial constraints, demanding curricula, and multilingual instruction, which intensify dysfunctional attitudes; parental expectations add stress for 56% of undergraduates, and 72% report grading discrimination as a major academic stressor [20]. Neuroticism, associated with distorted thinking, promotes dysfunctional attitudes that further impair academic performance [21]. Research in Nigeria has investigated similar effects of cognitive distortions on student performance [22].

A paper in Lecture Notes in Education, Psychology and Public Media demonstrates how cognitive distortions affect academic achievement [15]. For medical students at Wah Medical College, who experience elevated levels of cognitive distortions [23], it is crucial to determine the academic impact. This study will add to the existing literature and help students correct maladaptive cognitive patterns. Therefore, this study aimed to determine the distribution of specific cognitive distortions among MBBS students at Wah Medical College using the Cognitive Distortions Scale related to Academic Achievement (CDS-AA), and to evaluate the relationship between cognitive distortions and academic success by analysing correlations with scores from the previous year's professional exam.

Materials & Methods

Design and setting(s)

A quantitative, cross-sectional study was conducted using the CDS-AA questionnaire [24] over a total study period of six months (including protocol development, data collection, and analysis). The research was conducted at Wah Medical College, a private medical institution offering a five-year MBBS programme. Active data collection took place over two months (01 August 2025 to 30 September 2025) during a non-examination period.

Participants and sampling

The target population comprised approximately 650 second-year to final-year MBBS students and recent graduates from the same institution. Students were eligible if their previous professional examination results were available.

First-year students and those diagnosed with psychiatric disorders and currently receiving treatment were excluded. A non-probability convenience sampling technique was used, recruiting participants based on availability and willingness during the collection period. The sample size was calculated using Raosoft (http://www.raosoft.com/samplesize.html) with a 95% confidence level, 5% margin of error, 650 population size, and 50% response distribution, yielding 242 participants, meeting the required minimum.

Tools/Instruments

The primary independent variable was total CDS-AA score; the dependent variable of interest was previous professional exam score (%), treated as continuous for correlation and regression. Other variables included gender, year of study, socioeconomic status, study hours per week, counselling frequency, and self-reported frequency of feeling burned out about academic work. The study used the CDS-AA, developed by Kaya, specifically designed to measure cognitive distortions in educational contexts.

The scale has demonstrated good internal consistency and test-retest reliability [24]. After translation from Turkish to English, a pilot study confirmed contextual appropriateness. The scale consists of 25 items across four domains, using a 5-point Likert response format (1 = "Strongly Disagree" to 5 = "Strongly Agree"): Catastrophizing (items 1, 2, 9, 10, 17, 18, 24, 25), Self-

value (items 3, 4, 11, 12, 19, 20), External attribution (items 5, 6, 13, 14, 21, 22), and Perfectionism (items 7, 8, 15, 16, 23). Total scores range from 25 to 125, with higher scores indicating greater distortion. Two items were reworded for clarity after pilot testing, and the refined version was used in the main study.

Pilot study

A pilot study evaluated the contextual reliability of the English-translated CDS-AA using a structured forward translation process. An initial English version was generated and reviewed by bilingual medical students. Permission was obtained from the original author. Five students from the target population participated voluntarily in individual interviews. Each statement was presented, and participants were asked to share any difficulties in comprehension.

Feedback led to two revisions: in the catastrophizing section, from "The consequences of failure would be terrible and I can't stand it" to "The consequences of failure would be terrible, and I can't bear it"; and in the perfectionism section, from "I can never stand to fail" to "I absolutely can't tolerate failure". In the present study, the translated CDS-AA showed acceptable internal consistency, with Cronbach's alpha = 0.723. Subscale-specific reliability and confirmatory factor analysis were not performed.

Data collection methods

After ethical approval from the Institutional Review Board of Wah Medical College, eligible participants were invited. Written informed consent was obtained. The questionnaire was administered via Google Forms, distributed through WhatsApp groups, with settings adjusted to allow only one response per participant. Data were collected during a non-examination period to reduce acute stress effects. Previous professional examination scores were obtained from the Student Affairs Department with permission.

Data analysis

Analyses were performed using IBM SPSS and Microsoft Excel (2016). Descriptive statistics summarised cognitive distortion prevalence and academic performance. Reliability (Cronbach's alpha) was assessed. Independent t-tests and ANOVA compared CDS-AA scores across demographic and other variables. Pearson correlation examined relationships between total and subgroup CDS-AA scores and exam scores. Multiple regression was conducted with exam score as the dependent variable and the four CDS-AA subscales as independent variables. All tests were two-tailed, with significance set at $p < 0.05$.

Results

The sample was nearly evenly distributed by gender, with a slight male majority. Participant flow is shown in **Figure 1**. The mean CDS-AA score was 81.51 (SD = 11.87). The highest subgroup mean was for catastrophizing (Mean = 26.31, SD = 4.85) and the lowest for perfectionism (Mean = 16.10, SD = 2.91). Descriptive statistics for CDS-AA and its subscales are shown in **Table 1**.

Table 1. Descriptive statistics for the cognitive distortions scale

Scale	Mean	SD
CDS-AA score	81.51	11.87
Catastrophizing score	26.31	4.85
Self-value score	19.67	3.39
External attribution score	19.43	3.49
Perfectionism score	16.10	2.91

Abbreviations: SD, standard deviation; CDS-AA, cognitive distortions scale related to academic achievement.

Total CDS-AA scores were categorised using the standard deviation method into Low, Moderate, and High. Cut-off scores were 69.64 (Mean – 1SD) and 93.38 (Mean + 1SD). Prevalence of distortion levels is summarised in **Table 2**. The total CDS-AA score distribution (Mean = 81.51, SD = 11.87) was approximately normal, as shown in **Figure 2**.

Table 2. Prevalence of cognitive distortions

CDS-AA Level	Frequency (n)	Percent (%)
Low distortion	37	15.3
Moderate distortion	166	68.6
High distortion	39	16.1
Total	242	100.0

Abbreviations: n, number of participants; CDS-AA, cognitive distortions scale related to academic achievement.

An independent samples t-test showed no significant difference between males (Mean = 81.55, SD = 11.28) and females (Mean = 81.46, SD = 12.5), t = 0.059, p = 0.953.

Levene's test was significant (F = 4.078, p = 0.045), so equal variances were not assumed. Similarly, no significant difference emerged between middle-class (Mean = 83.23, SD = 12.67) and upper-class (Mean = 80.17, SD = 11.07) students, t = 1.97, p = 0.050 (Levene's F = 4.82, p = 0.029). One-way ANOVA showed a

significant overall difference in CDS-AA scores across counselling-frequency groups, $F(5, 236) = 2.610$, $p = 0.025$. However, Tukey HSD post-hoc comparisons revealed no significant pairwise differences (all adjusted $p \geq 0.085$), indicating only a weak overall effect.

Another ANOVA found no significant difference in CDS-AA scores across self-reported academic burnout frequency categories, $F(4, 237) = 0.734$, $p = 0.570$ (this variable was measured with a single subjective item and should be interpreted cautiously). CDS-AA scores differed significantly across academic years, $F(4, 237) = 8.061$, $p < 0.001$. Means were highest among second-year (86.16), third-year (84.18), and fifth-year (83.98) students, and lower among fourth-year (77.22) and graduates (75.98).

Tukey HSD post-hoc comparisons showed that graduates scored significantly lower than fifth-year, third-year, and second-year students; fourth-year students also scored significantly lower than those same three groups. No significant differences were found between second-, third-, and fifth-year students, nor between graduates and fourth-year students (**Table 3**).

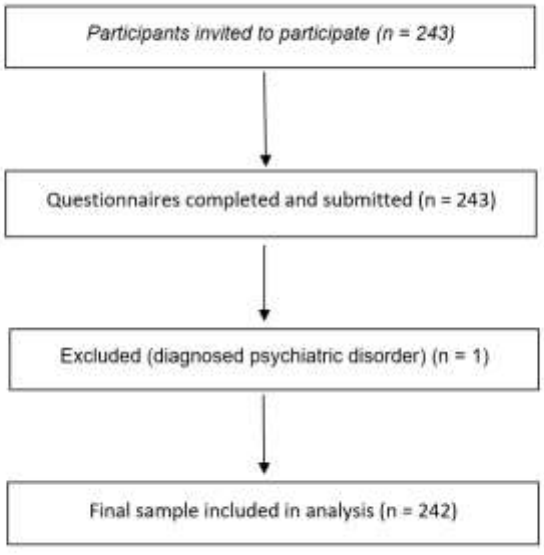


Figure 1. Flow diagram of participants included in the study

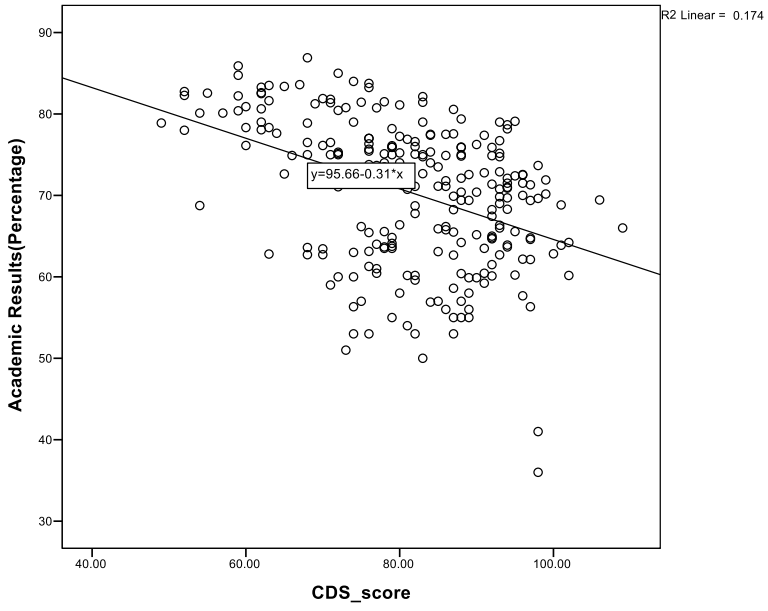


Figure 3. Scatter plot of CDS-AA score vs previous professional examination score (%)

An independent samples t-test showed no significant difference between males (Mean = 81.55, SD = 11.28) and females (Mean = 81.46, SD = 12.5), t = 0.059, p = 0.953. Levene's test was significant (F = 4.078, p = 0.045), so equal variances were not assumed. Similarly, no significant difference emerged between middle-class (Mean = 83.23, SD = 12.67) and upper-class (Mean = 80.17, SD = 11.07) students, t = 1.97, p = 0.050 (Levene's F = 4.82, p = 0.029). One-way ANOVA showed a significant overall difference in CDS-AA scores across counselling-frequency groups, F(5, 236) = 2.610, p = 0.025. However, Tukey HSD post-hoc comparisons revealed no significant pairwise differences (all adjusted p ≥ .085), indicating only a weak overall effect. Another ANOVA found no significant difference in CDS-AA scores across self-reported academic burnout frequency categories, F(4, 237) = 0.734, p = 0.570 (this variable was measured with a single subjective item and should be interpreted cautiously). CDS-AA scores differed significantly across academic years, F(4, 237) = 8.061, p < 0.001. Means were highest among second-year (86.16), third-year (84.18), and fifth-year (83.98) students, and lower among fourth-year (77.22) and graduates (75.98). Tukey HSD post-hoc comparisons showed that graduates scored significantly lower than fifth-year, third-year, and second-year students; fourth-year students also scored significantly lower than those same three groups. No significant differences were found between second-, third-, and fifth-year students, nor between graduates and fourth-year students (**Table 3**). Inferential statistics for CDS-AA total scores across demographic variables are summarised in **Table 4**.

Table 3. Tukey HSD post-hoc pairwise comparisons of CDS-AA total scores by academic year

Pairwise comparison	Mean difference	p-value	Interpretation
Graduated vs 5th year	- 8.000	0.006	Significant
Graduated vs 3rd year	- 8.205	0.004	Significant
Graduated vs 2nd year	- 10.184	0 < 0.001	Significant
Graduated vs 4th year	- 1.245	0.982	Not significant
4th year vs 5th year	- 6.754	0.029	Significant
4th year vs 3rd year	- 6.959	0.020	Significant
4th year vs 2nd year	- 8.939	0.001	Significant
2nd year vs 3rd year	1.980	0.907	Not significant
2nd year vs 5th year	2.185	0.876	Not significant
3rd year vs 5th year	0.205	1.000	Not significant

Note: Tukey HSD post-hoc test was used for pairwise comparisons following a significant one-way ANOVA.
Abbreviations: CDS-AA, cognitive distortions scale related to academic achievement; HSD, honestly significant difference.

Table 4. Inferential statistics for CDS-AA total scores across demographics

Demographic variable	Statistical test	Test value	df	p-value
Gender	Independent t-test	0.059	235.67	0.953
Socio-economic status	Independent t-test	1.967	209.43	0.050
Academic Year	One-way ANOVA	8.061	(4, 237)	0 < 0.001
Counselling-session frequency	One-way ANOVA	2.610	(5, 236)	0.025
Feeling of burnout	One-way ANOVA	0.734	(4, 237)	0.570
Study hours	One-way ANOVA	13.56	(3, 238)	0 < 0.001

Note: Independent t-test was used for comparisons between two groups. One-way ANOVA was used for comparisons among three or more groups. Levene's test was used to assess homogeneity of variances.
Abbreviations: CDS-AA, cognitive distortions scale related to academic achievement; df, degrees of freedom.

Pearson correlation showed a significant negative relationship (p < 0.001) between all four CDS-AA subscales and previous professional exam score (%). Total CDS-AA score correlated moderately and negatively with exam scores (r = - 0.417, p < 0.001). The strongest negative correlations were with catastrophizing (r = - 0.389, p < 0.001) and external attribution (r = - 0.328, p < 0.001). Subscales were moderately to strongly

intercorrelated, with the highest between catastrophizing and external attribution ($r = 0.616$, $p < 0.001$) Correlation coefficients are presented in **Table 5**. Derived VIF values based on the predictor correlation matrix were below 2.0 for all four subscales (**Table 6**), suggesting no severe multicollinearity. However, as subscales represent related constructs, individual predictor effects should be interpreted cautiously.

Table 5. Pearson Correlations Between previous professional examination score (%) and cognitive distortions (n = 242)

Variable	Previous exam (%)	Catastrophizing	Self-value	External attribution	Perfectionism
Total CDS score	- 0.417**	---	---	---	---
Catastrophizing	- 0.389**	1	0.569**	0.616**	0.488**
Self-value	- 0.314**	0.569**	1	0.563**	0.442**
External attribution	- 0.328**	0.616**	0.563**	1	0.481**
Perfectionism	- 0.291**	0.488**	0.442**	0.481**	1

Note: Pearson correlation coefficients are reported. **Correlation is significant at the 0.01 level (2-tailed).
Abbreviations: CDS, cognitive distortions scale; n, number of participants.

Table 6. Derived VIF values for CDS-AA subscales included in the multiple regression model

Predictor	Derived VIF
Catastrophizing	1.91
Self-value	1.70
External attribution	1.88
Perfectionism	1.45

Note: VIF values below 10 indicate no severe multicollinearity.
Abbreviations: VIF, variance inflation factor; CDS-AA, cognitive distortions scale related to academic achievement.

A multiple regression model examined whether the four CDS-AA subscales were independently associated with previous professional exam score (%). The overall model was significant, $F(4, 237) = 12.712$, $p < 0.001$, explaining 17.7% of the variance ($R^2 = 0.177$, adjusted $R^2 = 0.163$). Among the subscales, only catastrophizing was a significant independent predictor, $B = - 0.441$, $SE = 0.149$, $\beta = - 0.242$, $t = - 2.969$, $p = 0.003$, 95% CI [- 0.734, - 0.148]. Self-value, external attribution, and perfectionism were not statistically significant (**Table 7**). Simple linear regression showed total CDS-AA score was negatively associated with previous professional exam score (%), $B = - 0.311$, $SE = 0.044$, $\beta = - 0.417$, $t = - 7.101$, $p < 0.001$, 95% CI [- 0.397, - 0.225], accounting for 17.4% of the variance ($R^2 = .174$, adjusted $R^2 = .170$). A scatter plot is shown in **Figure 3**.

Table 7. Multiple regression analysis predicting previous professional examination score

Predictor	B	SE	β	t	p	95% CI for B
Constant	95.180	3.689	---	25.804	0 < .001	87.913 to 102.446
Catastrophizing	- 0.441	0.149	- 0.242	- 2.969	0.003	- 0.734 to - 0.148
Self-value	- .229	0.201	- 0.088	- 1.141	0.255	- 0.625 to 0.166
External attribution	- 0.215	0.205	- 0.085	- 1.049	0.295	- 0.619 to 0.189
Perfectionism	- 0.283	0.216	- 0.093	- 1.311	0.191	- 0.707 to 0.142

Note: Previous professional examination score (%) entered as dependent variable. B = unstandardised regression coefficient; SE = standard error; β = standardised regression coefficient; CI = confidence interval.
Abbreviations: CDS-AA, cognitive distortions scale related to academic achievement.

Discussion

The findings indicate that cognitive distortions were negatively associated with academic performance in this sample. Catastrophizing was the only subscale independently associated with previous professional examination score in the multiple regression model. However, given the cross-sectional design and intercorrelation among subscales, these results should be interpreted as associations, not causal evidence.

Consistent with prior studies, over half of participants experienced moderate cognitive distortions, and around 16% showed high levels. Algerian university students similarly displayed moderate distortion levels [25], Palestinian nursing students showed mainly mild/moderate levels [9], and Bangladeshi high school students exhibited significant distortions [8].

Catastrophizing had the highest mean score, while perfectionism had the lowest. Medical students face high-stakes testing and competitive examinations, which fuel anxiety and catastrophic predictions about their future careers [26]. They tend to show lower socially prescribed perfectionism but higher self-oriented perfectionism [27], which can be adaptive and necessary for professional growth.

Aligning with some previous literature [28], we found no gender difference in CDS-AA scores. This may be due to persistent exposure to high-performance demands, fear of failure, and high-stakes assessments [29], which produce similar cognitive distortions in individuals exposed to the same environment [30].

Our findings on academic year are consistent with earlier studies showing that preclinical training in early medical school years is marked by elevated maladaptive perfectionism, impostorism, and self-critical cognitions [31]. As medical training progresses, students' cognitive styles evolve; critical thinking may decline in later clinical years [32], while resilience and coping strategies may develop [33, 34], explaining lower distortion levels among senior students.

Students who studied more hours reported lower cognitive distortions, mirroring previous work showing that poor study habits increase stress and maladaptive cognition [35]. Lower distortion levels allow better focus and executive function during study, whereas higher distortion correlates with concentration difficulties and negative metacognitive beliefs, which may promote procrastination and avoidance behaviours [36, 37].

Our results on socioeconomic status contrast with studies showing that students from lower-income backgrounds have poorer mental health and cognitive outcomes [38, 39]. However, in Pakistani private medical education, high tuition fees restrict low-income enrolment, resulting in a more homogenous socioeconomic student body [40, 41], which may attenuate differences in cognitive distortions.

The counselling-frequency finding should be interpreted cautiously. Although the omnibus ANOVA was significant, Tukey HSD post-hoc tests revealed no significant pairwise differences, possibly due to the conservative adjustment, multiple categories, unequal group sizes, or a modest overall effect.

The nonsignificant finding for self-reported burnout frequency may be partly explained by the measurement approach: a single subjective item may not capture burnout's multidimensional nature. Thus, this result should not be taken as evidence that burnout is unrelated to cognitive distortions.

Our findings confirm that cognitive distortions are negatively associated with academic performance among MBBS students at Wah Medical College, aligning with cognitive theories that propose distortions as impediments to achievement [13]. Higher distortion levels correlate with lower grades, likely because distorted thinking affects concentration, cognitive function, anxiety levels, and ultimately performance [15, 16].

Catastrophizing emerged as the main predictor of lower exam scores. Students who exaggerated the consequences of failure tended to underperform, consistent with a UK study showing an inverse relationship between catastrophizing and examination performance [42].

These findings underscore the importance of cognitive behavioural therapy and academic counselling for student well-being and better academic outcomes. Future longitudinal, multi-institutional studies are needed to test directionality, and further research should examine the effect of cognitive distortions on performance using data collected during examination periods.

This study has several limitations. Its cross-sectional design prevents causal inference. It was conducted in a single private institution using convenience sampling, limiting generalisability to all Pakistani medical students. Although the translated CDS-AA showed acceptable overall internal consistency, subscale-specific reliability and confirmatory factor analysis were not performed, so construct validity of the adapted English version should be interpreted cautiously. Self-reported burnout frequency was measured with a single subjective item rather than a validated multidimensional scale.

Although derived VIF values did not indicate severe multicollinearity, the CDS-AA subscales were intercorrelated and represent related constructs; therefore, individual subscale regression coefficients should be interpreted with care. Future multicentre longitudinal studies using probability-based sampling and validated multidimensional measures are recommended.

Health educators worldwide confronting competitive exam challenges may gain valuable insights from this study, which highlights the negative association between cognitive distortions and academic performance using the reliable CDS-AA scale.

Conclusion

In this sample of medical students from a single private institution, cognitive distortions—particularly catastrophizing—were negatively associated with previous professional examination scores. These findings suggest that maladaptive academic thinking patterns may be relevant to academic performance and student well-being. Early identification of cognitive distortions and appropriate academic counselling may help support students, but future longitudinal and multicentre studies are needed before broader causal or generalisable conclusions can be drawn.

Ethical considerations

The ethical standards set by the Declaration of Helsinki [43] and the Institutional Review Board of Wah Medical College were followed throughout the study. Participation was voluntary, and written informed consent was obtained from every participant before data collection. Data confidentiality was ensured. The study protocol underwent review and received approval from the Ethical Review Committee (ERC)/Institutional Review Board (IRB) of Wah Medical College (Approval No. ERC/IRB/0078).

Artificial intelligence utilization for article writing

The authors used ChatGPT (OpenAI, 2025) only for language refinement, grammar correction, editing, and improving the clarity and structure of the manuscript. No artificial intelligence tool was used to generate original scientific content, research ideas, data, tables, figures, results, or interpretation of findings. Artificial intelligence was not listed as an author. All AI-assisted suggestions were reviewed, verified, and revised by the authors, who take full responsibility for the accuracy, integrity, and final content of the manuscript.

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Conflict of interest statement

No potential conflict of interest relevant to this article was reported.

Author contributions

MR contributed to conceptualization, data curation, methodology, formal analysis, validation, project administration, funding acquisition, writing the original draft, and review and editing of the manuscript. NA and SG contributed to formal analysis, validation, and review and editing of the manuscript.

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None

Data availability statement

The dataset, including raw CDS-AA scores, examination results, and demographic variables, is available from the corresponding author on reasonable request.

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